REMARKS/ARGUMENTS

In the examiner's Office Communication, dated September 13, 2006, in response to the applicant's Remarks/Arguments in the Response under 37 CFR § 1.116, filed on August 29, 2006, the examiner provided a series of assertions about the prior art, particularly Freeman, and about combinations of Freeman and Bevenot that indicate significant issues about features of this invention have not yet been fully joined and that further examination is warranted. The new method claims 40-49 and amendments to claims 19, 21, and 28 are added to help focus the examination in a manner that highlights some of the important distinctions of the present invention over the prior art that may have been overlooked. These and other claims and distinctions are discussed in more detail below.

First, several fundamental misconceptions need to be addressed, which may go to the heart of the failure of the applicant so far to reach a common ground with the examiner. In the September 13, 2006, Communication, the examiner wrote:

> Applicant also argues that a hydrogen concentration in Freeman's chamber 7 is not the same thing as diffusible hydrogen concentration in his object 1 from which the hydrogen evolves, but applicant provides no reasoning or evidence to support this argument. First, Examiner has not argued that Freeman alone quantifies diffusible hydrogen concentration. Freeman in view of Bevenot makes obvious the determination of concentration. Second, Examiner finds that the hydrogen measured in Freeman is the same thing as diffusible hydrogen since the only source of hydrogen in Freeman's chamber is the metal object. In other words, the chamber only contains hydrogen that has diffused from the metal object. Therefore the chamber contains diffusible hydrogen.

To understand the invention, it is essential to distinguish between hydrogen in the metal object, which can diffuse, i.e., spread out and move, through and out of the metal of the object, and hydrogen that is no longer in the metal of the object. It is also essential to understand the difference between a quantity or amount of hydrogen and a concentration of hydrogen. Concentration of hydrogen is the relative amount of hydrogen in and among an amount of other material.

Diffusible hydrogen concentration refers to hydrogen that is in the metal object – specifically, volume of hydrogen per unit mass in the object (see Specification, page 4, lines 7-8), and it is commonly quantified in milliliters or microliters of hydrogen per 100 grams of metal (ul/100 g) (see Specification, page 13, lines 19-21). After the diffusible hydrogen has diffused out of the metal object, it is no longer diffusible hydrogen in the metal object, and it is no longer any part of the concentration of diffusible hydrogen in the object. Therefore, when a claim recites "diffusible hydrogen concentration in an object," such as in a welded metal joint, it means the volume of diffusible hydrogen <u>in the object</u> per unit mass of the object, which is completely different than any hydrogen concentration in the sample chamber outside of the metal of the object. The fact that hydrogen in the sample chamber may have once been part of the diffusible hydrogen in the object metal does <u>not</u> make hydrogen concentration in the sample chamber the same as diffusible hydrogen concentration in the metal object. Further, and even more fundamental, <u>a measure of hydrogen concentration in the sample chamber is not the same thing as a measure of diffusible hydrogen concentration in the metal object</u>, even though the hydrogen in the sample chamber may have evolved from the metal object. Much more is required to correlate measures of hydrogen concentration in the sample chamber with a diffusible hydrogen concentration in the metal object, which is the subject matter of this invention.

Furthermore, the diffusible hydrogen concentration in the metal object changes over time as diffusible hydrogen diffuses out of the metal object. Therefore, for example, the initial diffusible hydrogen concentration in a weld joint immediately after the joint is welded is not the same as the diffusible hydrogen concentration in the weld joint after a passage of time. That much is known in the prior art.

However, none of the prior art references cited teach or fairly suggest using a correlative relationship between diffusivity rate of hydrogen evolving from a solid metal object and the diffusible hydrogen concentration in the object at particular times, much less to determining diffusible hydrogen concentrations in the solid metal object at other times. For example, as explained in the specification, page 15, lines 1-10, the inventors found experimentally that the slope of the sensor response curve correlates to initial diffusible

hydrogen concentration in a weld sample and to slopes of curves developed from a theoretical diffusion equation, based on a form of the error function equation.

The inventors took advantage of those curve slope relationships to correlate sampler measurements (e.g., light intensity as affected by a chemochromic hydrogen detector) taken some time after the initial weld was made (e.g., two hours later) to determine diffusible hydrogen concentration clear back in time to the initial diffusion hydrogen concentration in the weld. To do so, as explained in the specification, page 15, lines 11-23, the theoretical diffusion equation was used to generate solutions for a plurality of different example initial diffusible hydrogen concentrations for various times, e.g., at two-hour intervals. Therefore, because the respective slopes of those theoretical curves for a certain time are based on particular selected example initial diffusible hydrogen concentrations, the slopes of actual diffusion curves measured with the sampler at such a certain time, e.g., two hours, after the weld is made can be correlated to the theoretical example curve slopes to pinpoint what the initial diffusible hydrogen concentration was in the welded joint immediately after the weld was made.

None of the prior art references teach or suggest, let alone use, these relationships with hydrogen sensing samplers to determine diffusible hydrogen concentrations in metals. Therefore, the pending claims are clearly patentable over the prior art references cited, and the examiner is requested to grant an early allowance. If any issues remain to be resolved, the examiner is requested to contact the applicant's attorney at the telephone number listed below.

Respectfully submitted,

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